REMARKS

Claims 21-24 and 31-32 are all the claims presently pending in the application. Claims 1-20 and 25-30 have been canceled. Claim 21 has been amended to further define the claimed invention. Claims 31-32 have been added to claim additional features of the claimed invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 21-23 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Yamazaki et al. (U.S. Patent No. 4,987,008). Claim 24 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamazaki et al. in view of Kern, "*Handbook of Semiconductor wafer cleaning Technology*".

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

The claimed invention, as recited in claim 1, is directed to a method for manufacturing a group III nitride compound semiconductor device. The method includes irradiating a surface of a wafer with ultraviolet rays to thereby clean said surface of said wafer. Importantly, the ultraviolet rays cause a reaction of oxygen molecules to form stimulated oxygen atoms having a strong oxidative power at the surface of the wafer.

As explained in the present Application, conventional methods for manufacturing a group III nitride compound semiconductor device use either a chemical treatment or an O_2 plasma treatment to clean a surface of the device (Application at page 2, line 19-page 4, line 3). However, such treatments often damage the layers of the semiconductor device (Application at page 2, lines 21-22; page 3, lines 6-8)

The claimed invention, on the other hand, irradiates a surface of the semiconductor device with ultraviolet (UV) rays which cause a reaction of oxygen molecules to form stimulated oxygen atoms having a strong oxidative power at the surface of the wafer.

(Application at page 5, line 26 - page 6, line 4; and page 16, line 14 to page 27, line 8). As discussed in the Application, the stimulated oxygen atoms may oxidize an organic contamination on the surface of the wafer into CO, CO_2 and H_2O which flies up from the surface of the light-emitting device. Thus, unlike with conventional methods, with the claimed method, the UV rays effectively clean the surface without damaging the wafer (Application at page 4, lines 10-13).

II. THE PRIOR ART REFERENCES

A. The Yamazaki et al. Reference

The Examiner alleges that Yamazaki et al. teaches the invention of claims 21-23. Applicant submits, however, that Yamazaki does not teach or suggest the claimed invention.

Yamazaki discloses a method of forming a film which is intended to avoid damage on the surface of semiconductor. The Yamazaki method includes generating an active halogen or active hydrogen by a photochemical reaction, and cleaning the surface of the semiconductor **by removing oxides** formed thereon by means of the active elements (Yamazaki at Abstract).

Applicant submits, however, that Yamazaki does not teach or suggest *"wherein said ultraviolet rays cause a reaction of oxygen molecules to form stimulated oxygen atoms having a strong oxidative power at said surface of said wafer"*, as recited in claim 21.

As noted above, unlike conventional methods for manufacturing a group III nitride compound semiconductor device which use either a chemical treatment or an O_2 plasma treatment to clean a surface of the device, the claimed invention, irradiates a surface of the semiconductor device with ultraviolet (UV) rays which cause a reaction of oxygen molecules to form stimulated oxygen atoms having a strong oxidative power at the surface of the wafer. (Application at page 5, line 26 - page 6, line 4; and page 16, line 14 to page 27, line 8).

As discussed in the Application, the stimulated oxygen atoms may oxidize an organic contamination on the surface of the wafer into CO, CO_2 and H_2O which flies up from the surface of the light-emitting device. Thus, unlike with conventional methods, with the claimed method, the UV rays effectively clean the surface without damaging the wafer (Application at page 4, lines 10-13).

Clearly, these features are not taught or suggested by Yamazaki. Indeed, Applicant notes that the Yamazaki device is not intended to remove organic contaminants (e.g., organic resist residue) but is instead intended to remove oxides (e.g., see Yamazaki at col. 14, lines 30-37). The Yamazaki method generates active hydrogen on a semiconductor surface by photo-activating nonoxide hydrides (e.g., NH_3) (Yamazaki at col. 2, lines 8-34), so that the active hydrogen reacts with the oxides (e.g., Ga_2O_3) to remove the oxides from the surface.

Thus, Yamazaki certainly does not teach or suggest irradiating a wafer surface with ultraviolet (UV) rays which cause a reaction of oxygen molecules to form stimulated oxygen atoms having a strong oxidative power at the surface of the wafer. Indeed, **Yamazaki is intended to remove oxides and thus, would likely seek to avoid stimulated oxygen atoms having a strong oxidative power at the surface of the wafer**. Thus, Yamazaki is completely unrelated to the claimed invention and, in fact, teaches away from the claimed invention.

Further, with respect to claim 22, Applicant would respectfully submit that the Examiner has clearly failed to show that Yamazaki teaches or suggests irradiating a wafer surface with ultraviolet rays have a central wavelength of 172 nm. Indeed, the Examiner attempts to rely on col. 10, lines 54-60 (e.g., see also col. 14, lines 15-18) to support his position that Yamazaki teaches "irradiating the said surfaces with light in a wavelength from 100 to 400 nm (UV light)". However, Applicant submits that the Examiner is clearly incorrect.

In fact, Applicant would point out to the Examiner that "100 to 400 nm" is not a range of UV light, **it encompasses all UV light**. Therefore, the passage in Yamazaki on which the Examiner relies does not teach or suggest a "range" of UV light. That is, the term "UV light in a range from 100 to 400nm" has no different meaning than the term "UV light", and the Examiner cannot rely upon this to assert that Yamazaki teaches ultraviolet rays have a central wavelength of 172 nm as in the claimed invention.

Indeed, Applicant would also point out that these passages in Yamazaki (e.g., col. 10, lines 54-60 and col. 14, lines 15-18) merely are intended to **identify an operating range of the excimer laser**, and not to identify a recommended range of ultraviolet rays for irradiating a surface to clean the surface. Indeed, Yamazaki clearly states that the preferred wavelength

of the ultraviolet rays in his device is 185 nm (Yamazaki at col. 5, lines 13-15; col. 7, lines 27-30; col. 9, lines 5-7) or 185nm and 254nm (Yamazaki at col. 6, lines 48-54 and col. 12, lines 23-29). This is important because as noted above, the Yamazaki device is not intended to remove organic contaminants (e.g., organic resist residue) but is instead intended to remove oxides (e.g., see Yamazaki at col. 14, lines 30-37).

Applicant would respectfully submit that a preferred wavelength of UV rays for removing organic contamination is likely to be different than a preferred wavelength of UV rays for removing oxides and dirt. Therefore, the Yamazaki reference is completely unrelated to the claimed invention.

Therefore, Applicant submits that there are elements of the claimed invention that are not taught or suggest by Yamazaki. Therefore, the Examiner is respectfully requested to withdraw this rejection.

B. The Kern Reference

The Examiner alleges that Yamazaki would have been combined with Kern to form the invention of claim 24. Applicant submits, however, that these references would not have been combined and even if combined, the alleged combination would not teach or suggest each and every element of the claimed invention.

Kern discloses a ultraviolet (UV)/ozone cleaning method for cleaning semiconductor surfaces. Specifically, Kern discloses that UV light has the ability to depolymerize a variety of photoresist polymers (Kern at page 233, lines 19-20).

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions. Specifically, Yamazaki is directed to a method of removing oxide formations from a surface, whereas Kern is directed to depolymerization of polymers on a surface. Therefore, these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner merely states that it would have been obvious to combine these references in order to remove

impurities from p-type semiconductor layers. However, the Examiner's stated motivation to combine is completely unrelated to irradiating a surface of a wafer after patterning a resist layer and, therefore, is insufficient to support the alleged combination.

Moreover, Applicant submits that neither Yamazaki, nor Kern nor any combination thereof, teaches of suggests *"wherein said ultraviolet rays cause a reaction of oxygen molecules to form stimulated oxygen atoms having a strong oxidative power at said surface of said wafer"*, as recited in claim 21.

As noted above, the stimulated oxygen atoms may oxidize an organic contamination on the surface of the wafer into CO, CO_2 and H_2O which flies up from the surface of the light-emitting device. Thus, unlike with conventional methods, with the claimed method, the UV rays effectively clean the surface without damaging the wafer (Application at page 4, lines 10-13).

Clearly, these features are not taught or suggested by Kern. Indeed, Applicant would point out that Kern merely discloses removing a contaminant by cleaning action of UV/ozone. Nowhere does Kern teach or suggest removing contaminant from a wafer (e.g., including a group III nitride compound semiconductor such as GaN).

That is, nowhere does Kern teach or suggest ultraviolet rays causing a reaction of oxygen molecules to form stimulated oxygen atoms having a strong oxidative power at the surface of the wafer (e.g., **including a group III nitride compound semiconductor such as GaN**) as in the claimed invention. Thus, the Kern method is completely unrelated to the claimed invention in which the UV rays effectively clean the surface without damaging the wafer (e.g., **including a group III nitride compound semiconductor such as GaN**) (Application at page 4, lines 10-13).

Further, like Yamazaki, nowhere does Kern teach or suggest the features recited in claims 22-24 or new claims 31-32.

In addition, Applicant would point out that the Examiner is not relying on Kern as allegedly teaching this limitation, but instead relies on Kern as allegedly teaching *"wherein said irradiating said surface is carried out on a p-type semiconductor layer"* (As an aside, Applicant would point out that contrary to the Examiner's statement that Kern teaches that UV/ozone has been used to clean "many types of semiconductor surfaces", Kern states that

UV/ozone has been used to remove "a variety of contaminants from silicon, and compound semiconductor wafers, as well as from many **other types of surfaces**" (emphasis added). That is by "other types of surfaces" this passage implies "types of surfaces other than silicon and compound semiconductor wafers". Thus, nowhere does this passage teach or suggest irradiating a surface of a p-type semiconductor layer).

Kern teaches using UV laser irradiation having a wavelength of 193nm to etch biological and polymeric materials (Kern at page 162). Specifically, Kern teaches that a UV/ozone combination may be used to in a cleaning method (Kern at page 237).

However, the UV/ozone combination in Kern is completely different from the claimed invention. In fact, the Examiner is directed to the present Application at page 5, lines 14-30, which discusses an exemplary aspect of the claimed method in which UV radiation may cause a stimulated oxygen atom (e.g., O(1D) at line 21 on page 5) may be generated from an O_2 molecule. The UV radiation may "cut" the molecular chain of an organic contamination, then the stimulate oxygen atoms may act on the "cut" organic contaminations (Application at page 5, lines 26-32).

However, nowhere does Kern teach or suggest forming stimulated oxygen atoms having a strong oxidative power at the wafer surface (e.g., to cut the resist residue) as in the claimed invention. Thus, Kern clearly does not make up for the deficiencies of Yamazaki.

Therefore, Applicant submits that Yamazaki would not have been combined with Kern and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 21-24 and 31-32, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed

below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 12/29/04

Phillip E. Miller, Esq.
Registration No. 46,060

McGinn & Gibb, PLLC
8321 Old Courthouse Road, Suite 200
Vienna, VA 22182-3817
(703) 761-4100
Customer No. 21254

CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that the foregoing Amendment was filed by facsimile with the United States Patent and Trademark Office, Examiner Michail Kornakov, Group Art Unit # 1746 at fax number (703) 872-9306 this 29th day of December, 2004.

Phillip E. Miller
Reg. No. 46,060